Focusing with IDT mirror at sector S27 (V 1)

- Jan. 1st, 2015

1. Connect the Prosilica camera with power and network cables;

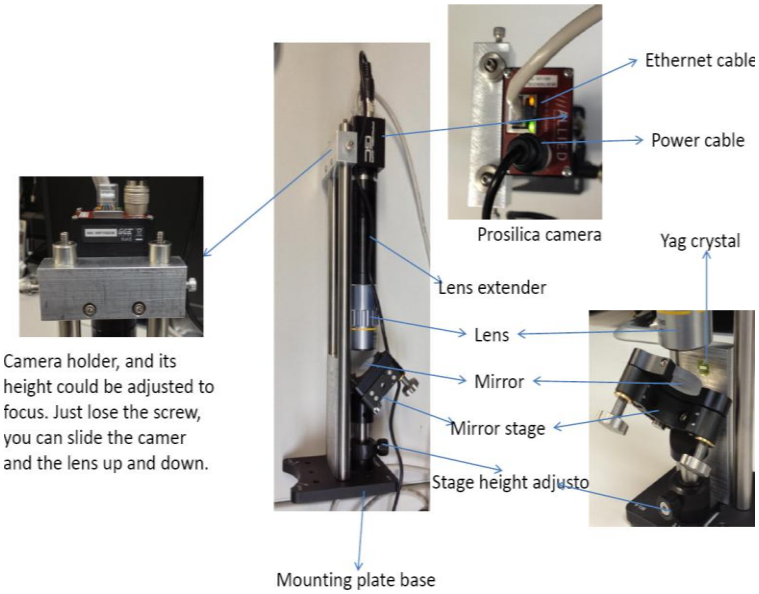


Fig. 1. The prosilica camera set

2. Type " start_ioc_procilica" in a terminal;

3. Then type "start_medm_procilica" in another terminal, and the medm window will pop up as shown in Fig 1;

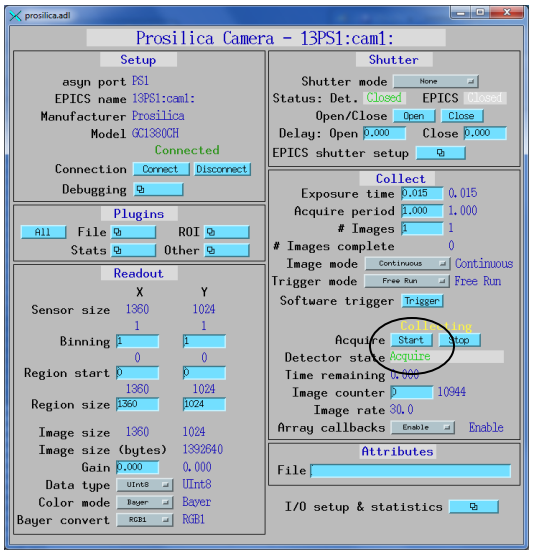


Fig. 2. The "medm" window

4. Then type “Image J” in another terminal;

5. In the “Plugins” of Image J, open “EPICS_AD_viewer”

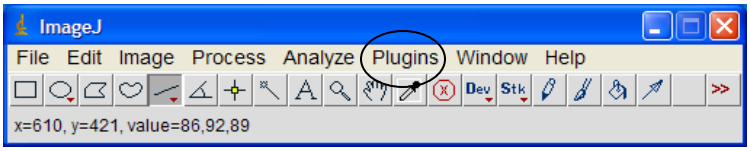


Fig. 3. The Image J window.

6. Click “start” in the “medm” window to acquire images (see Fig. 2).

7. Click “ start” in the “EPICS_AD_viewer”.

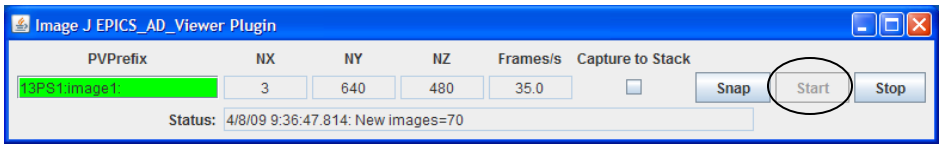


Fig. 4. The EPICS_AD_Viewer Plugin window

8. Then you should be able to see the image of the YAG crystal in the Image J Viewer. Sometimes, you may need to adjust the position of YAG crystal to have a better focusing.

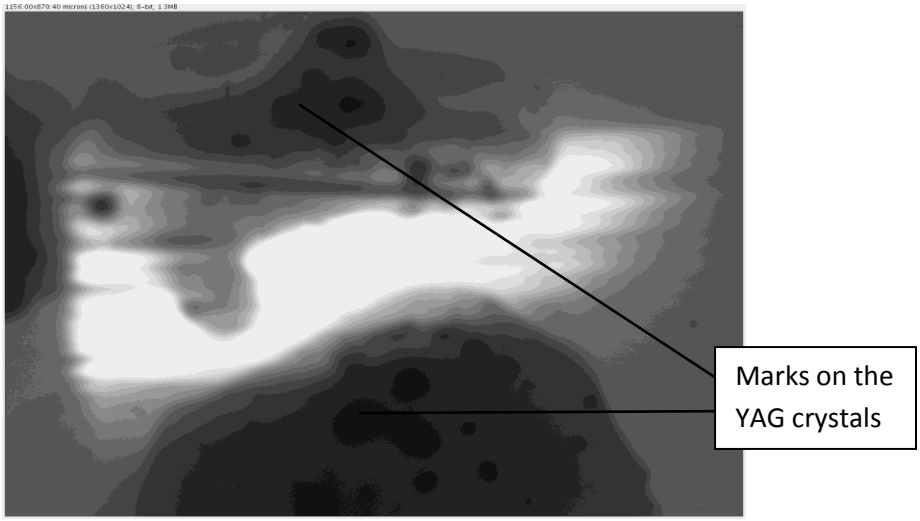


Fig. 5 The Marks on the surface of YAG crystal.

9. Then align the YGA crystal of prosilica camera (through the adopter and micropositioning stage) to the rotation center, until the marks on the surface of YAG crystal are best focused in the Image viewer J.

The marks are aligned on the rotation center , which are viewed through the "rotation center camera" fixed on the spectrometer.

Fig. 6 The marks on surface of YAG, which is viewed from rotation camera.

10. Put a fluorescence screen in front of YAG holder to find the beam and then using table x, y, z to bring the YAG to the (un)focused beam.

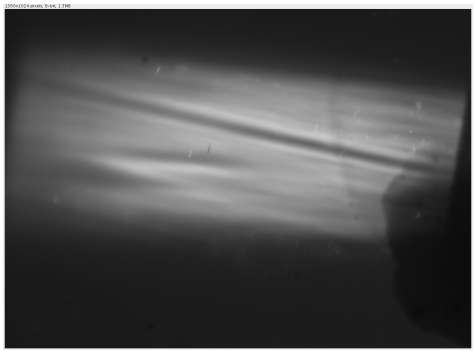


Fig. 7 unfocused beam on the YAG crystal.

Fig. 8 fluorescence screen shows where are the direct and reflected beams.

11. Open the mirror motor control windows

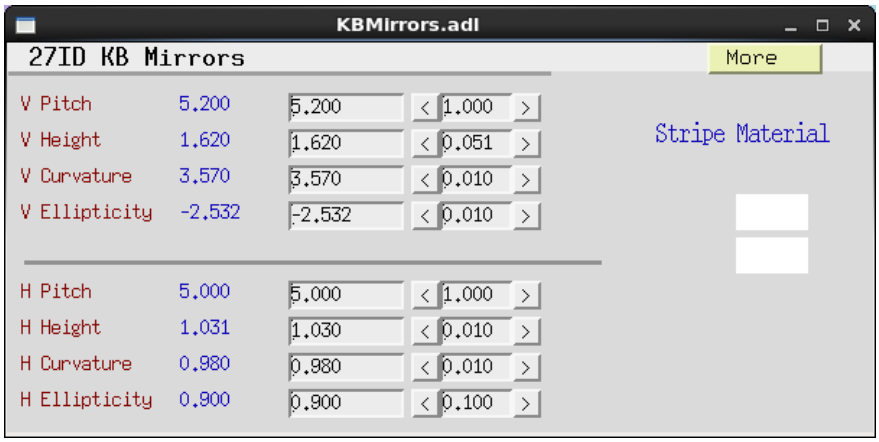


Fig. 9 The EPICS windows for mirror control.

12. Move vertical mirror into the beam (using mirror height) and calibrate the "zero" pitch angle. The criteria is: when the beam is parallel to the surface of mirror, increasing of pitch will reflect the beam and decreasing of pitch will cut the beam.

13. Do the same calibration of pitch angle for horizontal mirror.

14. Then tilt the vertical and horizontal mirror to 4 mrads to obtain a double reflected beam as showed in Fig. 10.

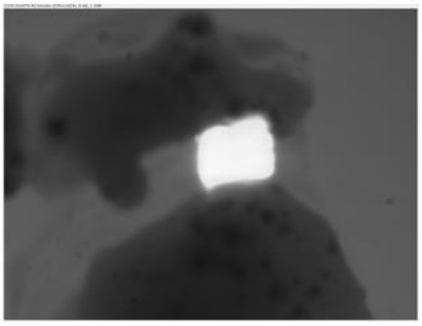


Fig. 10. The doubly reflected beam on the YAG crystal.

15. Then optimize the mirror height using PIN diode.

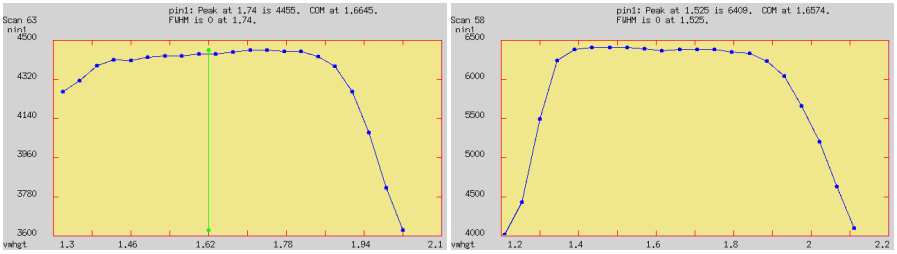


Fig 11. The scans of height of mirros using PIN diode.

16. Finally, increase “Curvature” and play “Ellipticity”. It will take several iterations until a best focused beam is obtained.

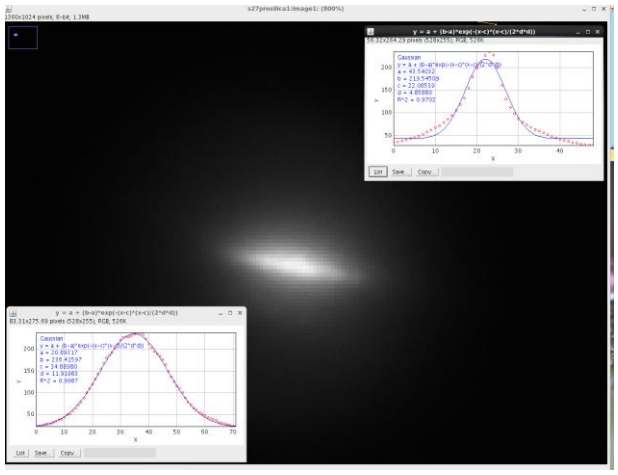


Fig. 12. The focused beam,

17. The beam line profile can be fitted with Image J using Gaussian peak shape. The calculation formula is FWHM of peak = d*2.352*0.85 (0.85 micron is the pixel size in the image taken from the prosilica camera at S27).

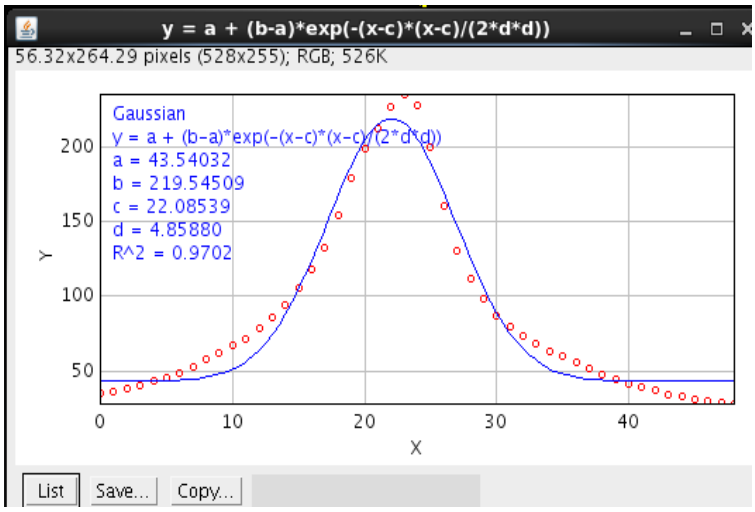


Fig. 13 The Gaussian fitting of the vertical beam profile

Trouble shootings:

If there is no image appearing on the Image J Viewer.

Solutions:

(1) Check if the environment parameters are set correctly:
You should set the environment variable EPICS_CA_MAX_ARRAY_BYTES to 10000000 (10 million). This needs to be set both in the process running the IOC and in the process running ImageJ. The best thing to do is to put it in your login shell script. The details depend on which shell you are using. For bash you edit the file ~/.bash_profile and add the line:

export EPICS_CA_MAX_ARRAY_BYTES=10000000

For the csh or tcsh you edit the file ~/.cshrc and add the line:

setenv EPICS_CA_MAX_ARRAY_BYTES 10000000

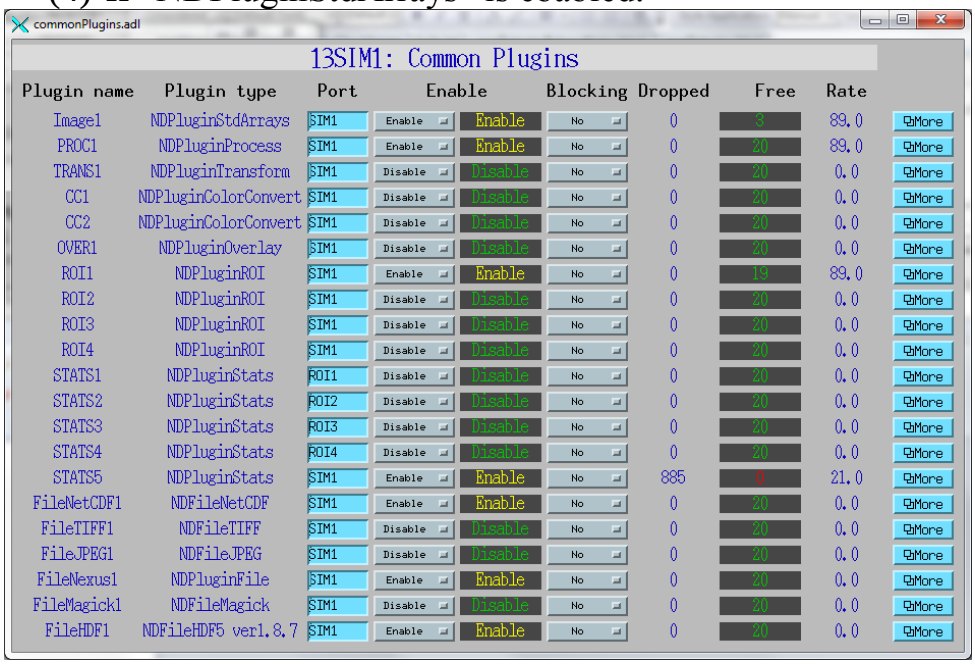
Once you do this you should log out and log back in, just to make sure you did it right. Then type

echo $EPICS_CA_MAX_ARRAY_BYTES and it should show you the value.

(2) If the Prosilica IOC was running on two different computers

(3) If "ArrayCallbacks was enabled in the main prosilica.adl medm screen.

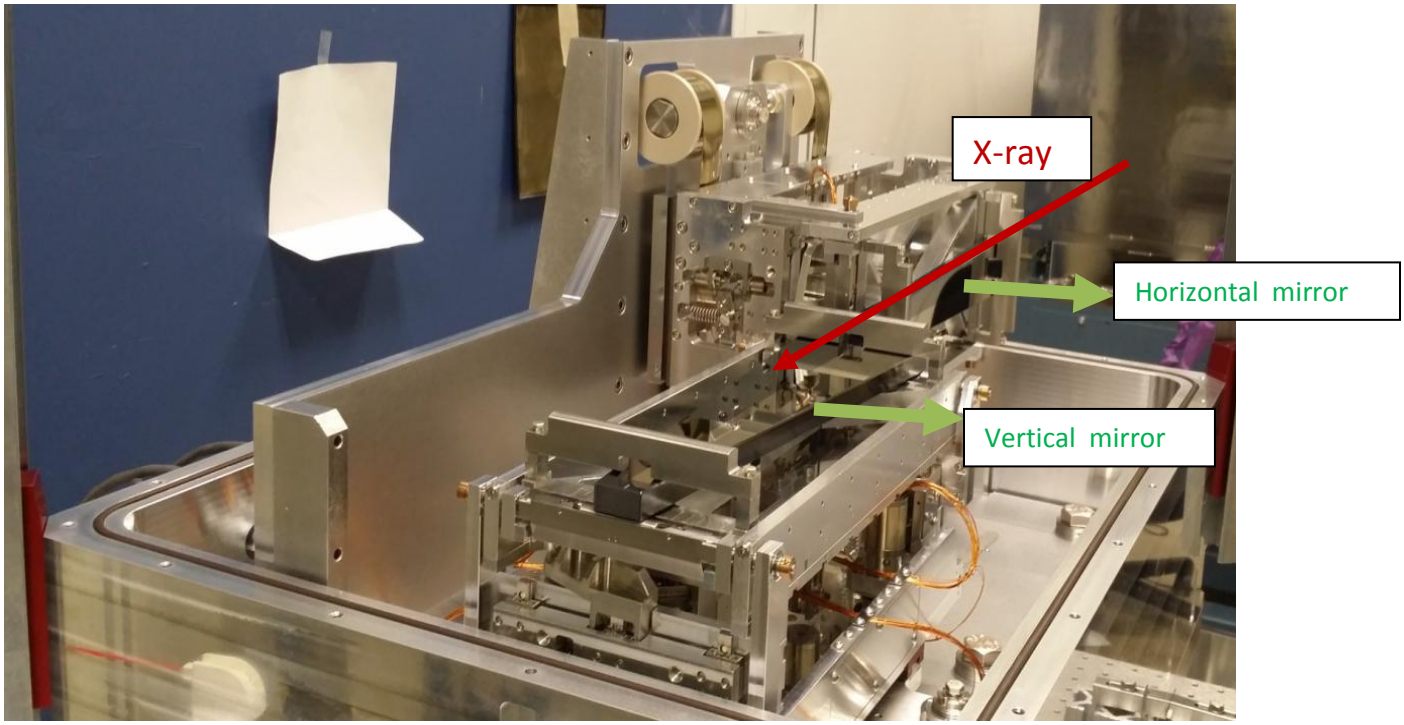
(4) If “NDPluginStdArrays” is ebabled.

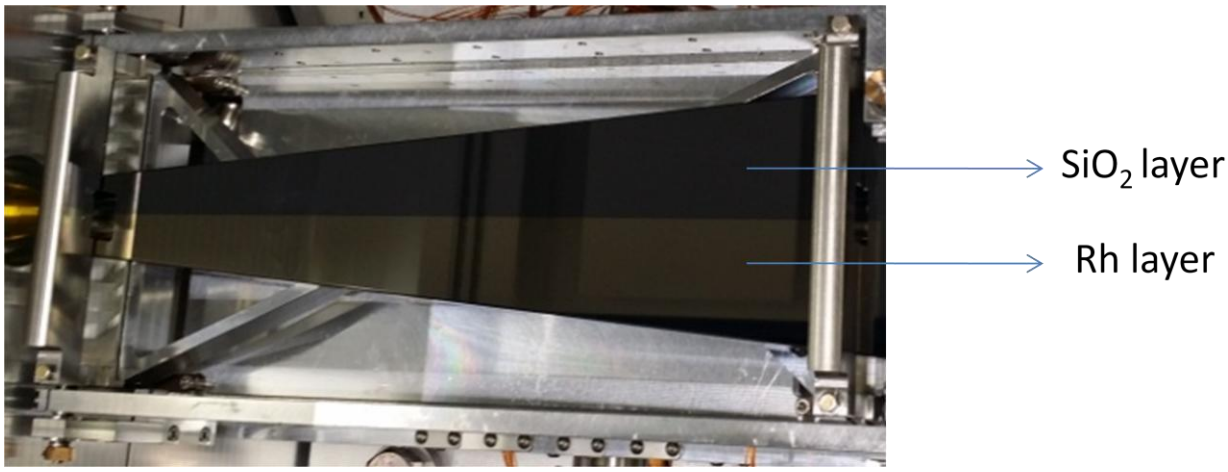


Some parameters to remember

(1) The height of beam after mmE is about 78 mm (to ground);
(2) The height of beam after single-channel-cut 844 is about 71 mm;
(3) The length of mirror = 320 mm;
(4) The current vertical and horizontal mirror to rotation center are 7.8mm/8mrad=0.975 m and 11.1mm/8mrad=1.388 , respectively.
(5) The reflectivity of verictal mirror is about 85% at 4 mrad for 11.215 keV x-ray.
(6) The typical well focused should be ~ 10 μm (V) X 22 μm (H) at current configuration.

The IDT mirrors





One example:

Fig. 1 Undulator gaps and slits' size

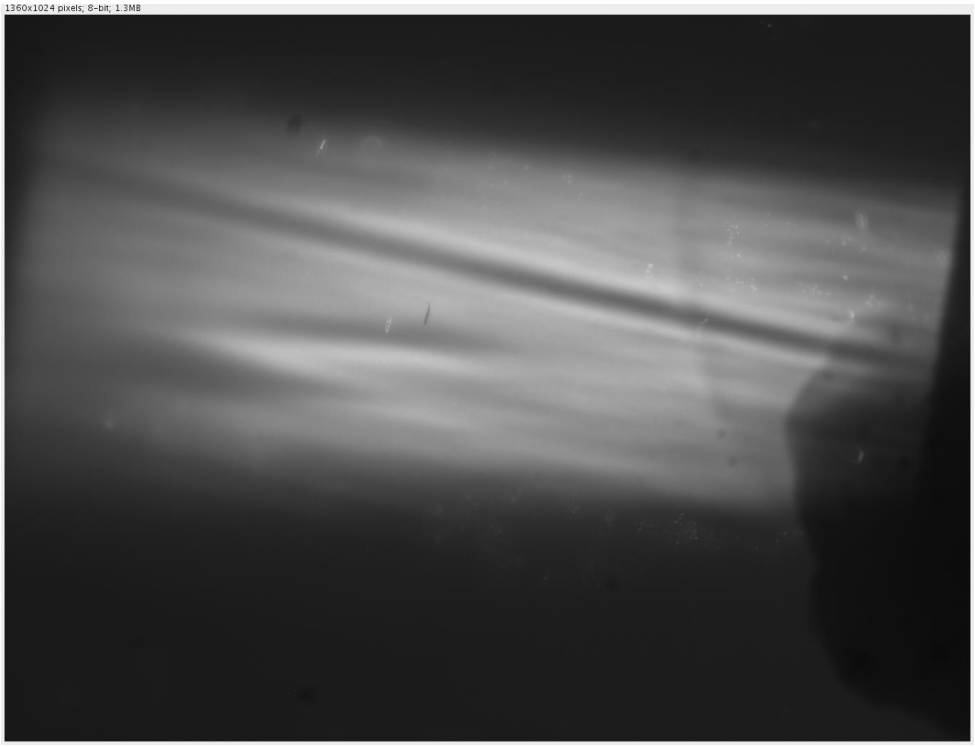


Fig. 2 The full beam on the YAG crystal; I0= 910000; Ipin= 7889 (1mA/V)

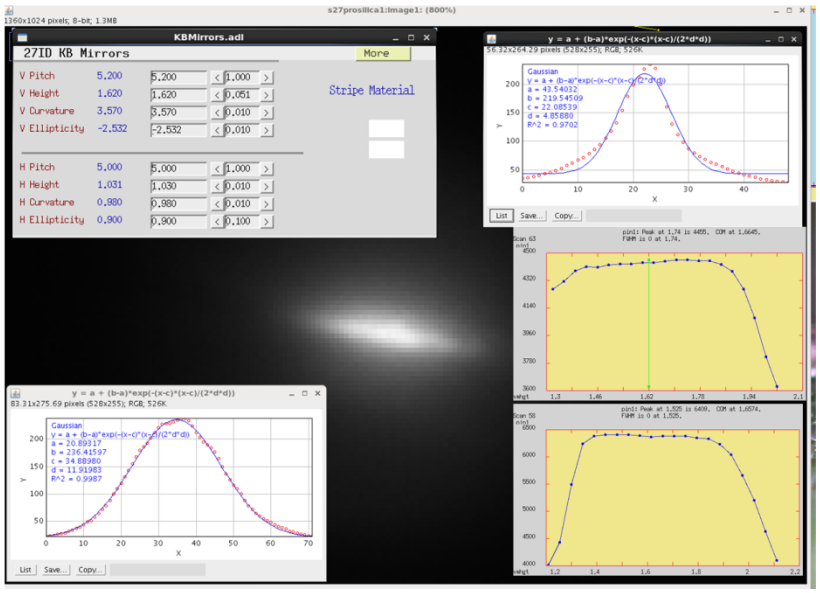


Fig. 3. The focused beam on YAG crystal. I pin = 4461 (1mA/v) ; Total efficiency ~ 57%; vertical efficiency ~83% . The size (FWHM) is 10 (V) micron x 22 micron